INSTRUCTION MANUAL

NO. 5922

BARBER COLMAN

Combustion Safeguards

model 1570 FLAME-OTROL

BARBER-COLMAN COMPANY
Industrial Instruments Division • Rockford, Ill., U.S.A.

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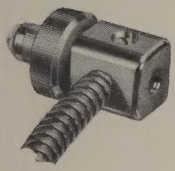


MODEL 1271-1
FLAME EYE

UL AND FM
APPROVAL

GENERAL

The Model 1570 Flame-otrol uses the Model 1271 Lead Sulphide Flame Eye Assembly. The photo-conductive lead-sulphide cell predominantly sensitive to infra-red energy, is used as flame "pick-up". The Flame Eye is arranged so that it can be used as a straight type unit, MODEL 1271, or as an angle type, MODEL 1271-1.

DESCRIPTION

The Model 1570 Flame-otrol provides flame failure protection for industrial and commercial burner systems. External Push Button is used for lighting pilot burners from which the main burners can be lighted. These may be gas, oil, or combination gas-oil burners.

Chassis is a plug-in type and can be removed by loosening of the center captive screw which reveals the terminals in the cabinet. The unit incorporates a time delay for starting, a safe-start proving period, and a flame relay. Pull in of flame relay by fire in combustion chamber or component failure prior to burner start-up will prevent powering of Time Delay Relay and pull in of safe-start relay, and prevent lighting off of burner.

Flame failure during operating cycle will cause fuel valve to be de-energized in 2 to 4 seconds.

SPECIFICATIONS

Model 1570 Flame-otrol using Model 1271 Flame Eye (straight) or Model 1271-1 Flame Eye (angle type).

Voltage and Frequencies: Available in 120, 240, or 208 volts (single voltage only must be specified). 50 or 60 cycles.

Power Consumption: 25 V.A.

Contact Ratings:

Terminals 1 and 3, 1 and 4, 5 and 6, and 11 and 13	250 V.A. Ignition or 125 V.A. Pilot Duty
Between 7 and 8	250 V.A. Ignition and 125 V.A. Pilot Duty

Maximum Ambient Temperature:	1570 Flame-otrol	125°F
	1271 Flame Eye	125°F
Flame Failure Response		2 to 4 seconds
Approximate Shipping Weight		15 pounds
Vacuum Tubes	2 Type 6SL7, and (1) 6SN7 Tubes should be replaced annually.	

INSTALLATION OF 1570 FLAME-OTROL

Model 1570 should be mounted in a vertical position either in a panel or to a wall. Location selected should not exceed maximum ambient temperature limit of 125°F.

Six conduit knockouts are located three on the top and three on the bottom of the cabinet. Bottom right hand knockout hole should be used only for the Flame Eye wiring. See Fig. A for dimensions. Wiring of Flame Eye only should be installed in separate conduit between case and Flame Eye. Conduit bonding should be maintained between 1570 Case and 1271 Flame Eye. This wiring should have a moisture resistant or plastic type insulation and should not be smaller than size #18. Wire having cotton, asbestos or similar type insulation should not be used.

If Model 1570 is mounted inside a control panel, shielded cable should be used from control case to terminals for external wiring of Flame Eyes. Flame Eye wiring should be separated from other external wiring from point of entry into control panel to terminal strips for external wiring of Flame Eyes. (Do not run unshielded

Flame Eye wiring in the same channel, trough or laced harness with power or control wiring.)

Power wiring should not be under size #14 and should be carried in rigid or flexible conduit. All wiring connections should be made directly to the terminal strips provided at both sides of the case. All wiring should conform to National Electric Code and local codes or ordinances which apply.

INSTALLATION OF FLAME EYE SCANNER

Model 1271 Flame Eye should be installed as per burner manufacturer's recommendations. If such information is not available, Flame Eye should be installed onto a ¾" black iron pipe threaded to receive #6-103 plastic insulating nipple. (See Fig. C.). Opposite end of #6-103 has ¾" thread to receive threaded collar of Flame Eye. The #6-103 plastic insulating nipple will eliminate problems of conducted heat from black iron pipe.

The sighting nipple should not be extended more than halfway through the refractory wall and should be installed in such a manner so that the background viewed in combustion chamber is relatively dark. The lead sulphide type Flame Eye operates on an infra-red radiation of a flame which has a pulsating or fluctuating nature. These pulsations or fluctuations are in the nature of a "flicker" at a frequency to which control operation is designed. Heated refractory surfaces also radiate an infra-red wave but it is steady and does not flicker as that radiated by the flame. The refractory radiation will not in itself actuate the flame relay of the control through the electronic network as the radiation from a flame. However, the refractory radiation within a chamber can be caused to flicker by air movements or steam, (in case of steam atomizing type oil burners) and cause false hold in after the flame of the burner has gone out.

Another condition which can occur from refractory radiation is one in which the signal from very hot refractory overwhelms the signal from the flame and causes the Flame Eye to become blinded and control shutdown occurs. This can be compared to looking at a lighted match in your hand with your back to the sun, and then turning around into the rays of the sun with the lighted match. The sun overwhelms the flame from the match to the point where not even the hand is visible. This is a similarity between a lead sul-

phide cell and the human eye. In this respect the sighting tube should be installed to sight into the dark or coolest background of the combustion chamber.

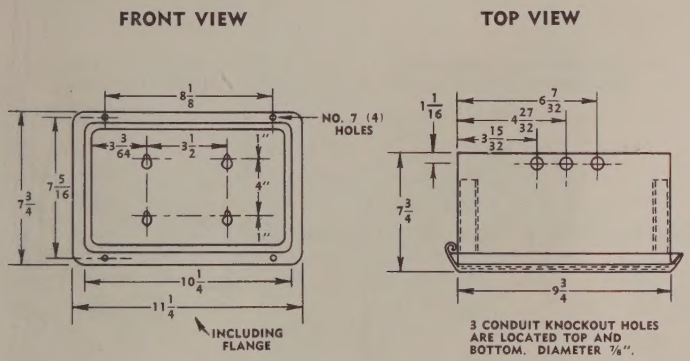
In cases where high radiation backgrounds are present, orificing may be necessary to reduce the viewed background and eliminate the undesirable refractory signal. Orificing may also be used as a means of setting the opening to the Flame Eye so that it will be the proper size when actual flame signal is present, but will not receive sufficient signal through this size opening when air or steam is causing a "flicker" in the refractory radiation.

If hot gases reach Flame Eye due to pressure in combustion chamber, or from down drafts of stack between burner operating cycles, A-3561—Orificing-Sealing Assembly should be used. (See Fig. B.). Temperature at Flame Eye should not exceed 125°F as temperatures above this point will reduce sensitivity of lead sulphide cell. When heat condition is being caused by radiated heat from burner or boiler front, increase length of black iron pipe nipple. In the event the required additional length of pipe is impractical, cooling air should be applied through opening provided in #6-103 plastic insulating nipple for accommodation of $\frac{1}{8}$" tubing fitting. (Opening is sized for $\frac{1}{8}$" N. P. Tap).

Flame Eye alignment for interrupted pilot ignition should be set so that the pilot flame is viewed at the point where ignition of main flame should occur. (See Fig. C.). This will allow Flame Eye to prove pilot flame and after ignition trial period is completed, it will supervise main flame. This requires only one Flame Eye which is connected to Terminals E and G.

On some installations two Flame Eyes per burner are often used. When using two Flame Eyes, one Flame Eye is used for viewing the pilot at the point where ignition should occur, and a second Flame Eye is used to view the main flame at a point where no flame from an adiacent burner will be seen. (See Fig. D.) The pilot Flame Eye is connected to Terminals E and G through a relay contact which closes when the Start Push Button is pressed. When the Push Button is released, the Pilot Flame Eye circuit is opened up and only the Flame Eye supervising the Main Flame is in operation across Terminals E and G. (See Fig. H.)

MOUNTING DIMENSIONS IN INCHES



SHELF MOUNTING

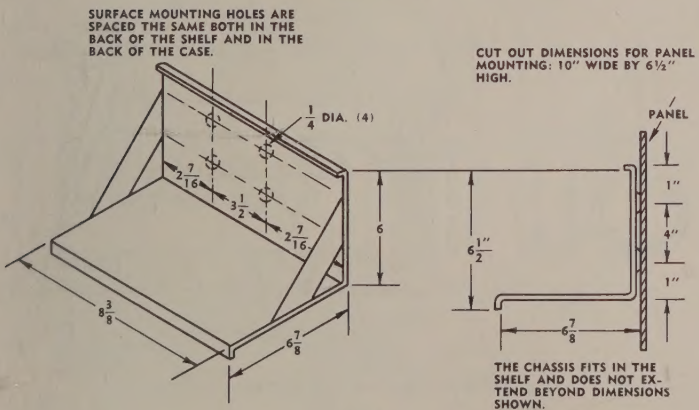
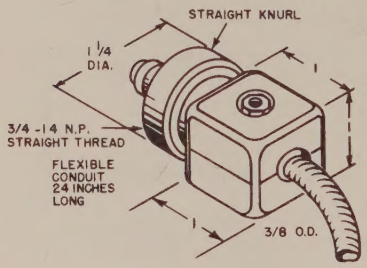

SURFACE MOUNTING HOLES ARE SPACED THE SAME BOTH IN THE BACK OF THE SHELF AND IN THE BACK OF THE CASE.
CUT OUT DIMENSIONS FOR PANEL MOUNTING: 10" WIDE BY 6½" HIGH.
1/4 DIA. (4)
PANEL
THE CHASSIS FITS IN THE SHELF AND DOES NOT EXTEND BEYOND DIMENSIONS SHOWN.

FIG. A

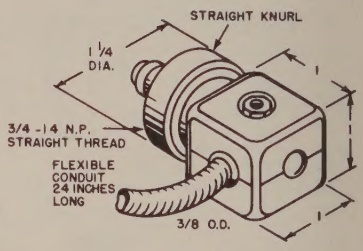
LEAD SULPHIDE PHOTOCELL A-3590

LENS ASSEMBLY A-3409

MODEL 1271—STRAIGHT INCLUDES A-3590 & A-3409



MODEL 1271-1 FLAME-EYE—ANGLE



INSULATING-ORIFICING ASSEMBLY FOR USE WITH FLAME EYE MODELS 1271 AND 1271-1

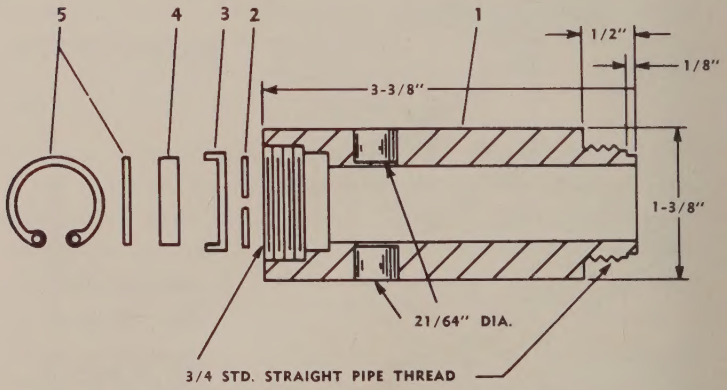


FIG. B

1. 6-103 Heat Resistant Insulating Nipple (Molded).
2. 13-1127 A, B, C, D (Blank, 1/32", 1/16", 1/8") Orifice (Aluminum).
3. Window Frame (Aluminum).
4. Window Glass (Pyrex).
5. Snap Ring.

} A-3650

NOTE: A. Above items (1 each) packed in box—Specify assembly A-3651.
B. 21/64" blind holes may be opened. Tap for 1/8" N.P.T. air connection.

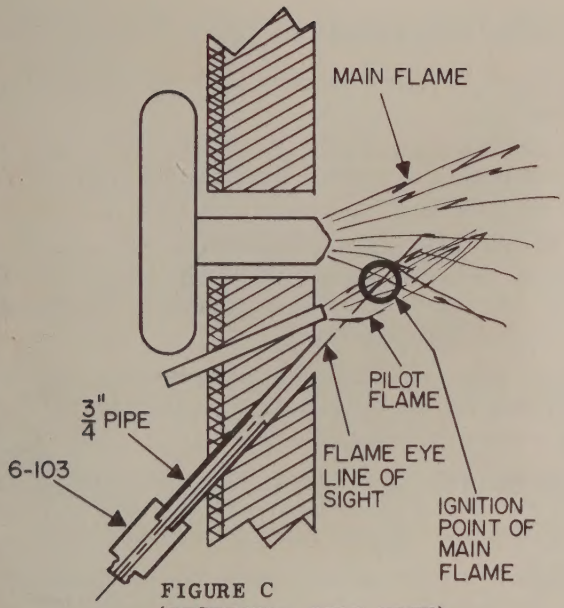


FIGURE C
(SECTIONAL SIDE VIEW)

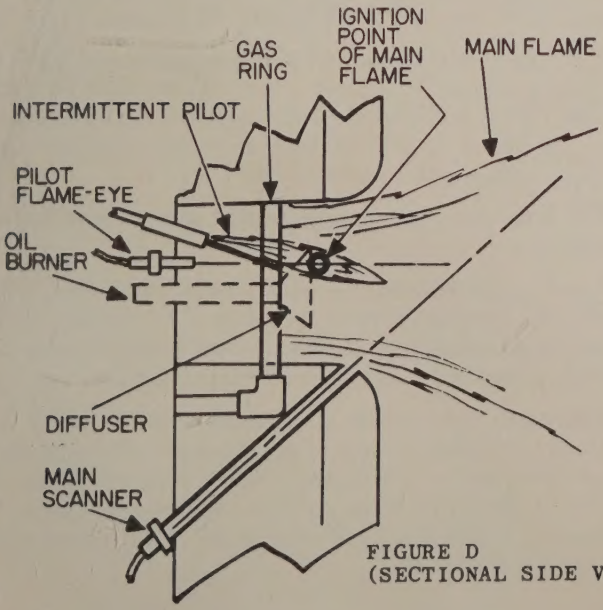


FIGURE D
(SECTIONAL SIDE VIEW)

SEQUENCE OF OPERATION (See Fig. E)

1. L1, L2 and 12 require power to begin the timing delay for starting.
2. Terminal 12 is energized from L1 through a limit switch (one or more switches as required and connected in series if more than one is used).
3. TD Thermal delay heater at Terminal 14 receives power from 2 through Normally Closed F Flame relay contact between 12 and 2, which is the safe-start requirement before starting to prove F relay in OFF position.
4. Thermal delay contact TD closes when the delay period completes (safe-start proving period) and operates the SS safe-start relay with power from 12.
5. SS safe-start relay closes contacts between Terminals 11 to 13, and 7 to 8, plus a self-holding contact connected to 9. Alarm or signal light at Terminal 4 powered indicating "ready".
6. PB push button receives power when SS relay operates, via SS contact between 7 and 8 which is powered from 12.
7. Operation of the PB energizes the IGN ignition transformer and the PV pilot valve from separate PB contacts.
8. The F flame relay operates from the pilot flame, closing F relay contacts between 5 to 6 and 3 to 1. At the same time, the F relay OFF contacts open and disconnect 2 from 12 and 4 from 1. TD heater de-energized and when cooled off TD contact opens. Alarm and signal light off.
9. MV main valve is energized from 5 through limit switches from L1.
10. Releasing the PB stops the IGN ignition transformer, but the PV pilot valve continues if the optional PV holding circuit is used and connected to 3, which became energized upon operation of the F relay from the pilot flame (pilot proving).
11. The signal light usually is connected along with the ALM alarm to Terminal 4 and indicates as a flame OFF signal during operation, and as a PB readiness signal. It operates at the same time as the alarm. When the signal light is connected to Terminal 2, it indicates the F relay in the OFF position without regard to the SS relay.

MODEL 1570 PUSH BUTTON START. PILOT PROVING.

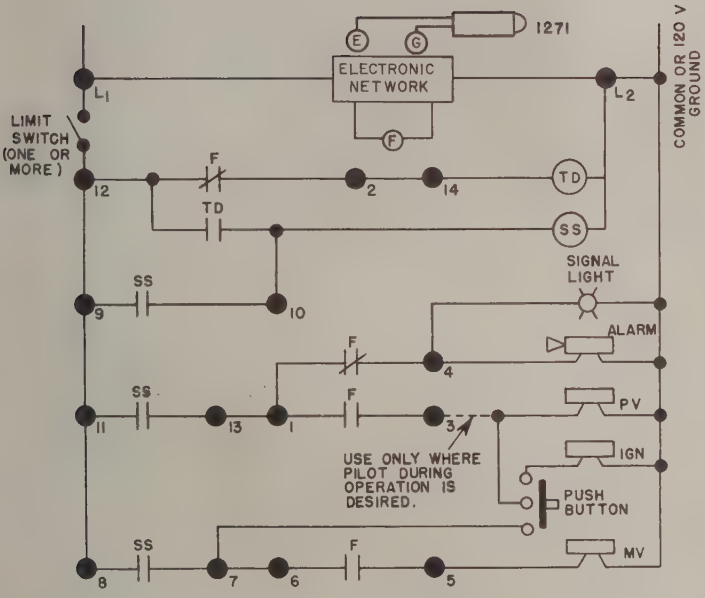


FIG. E

IDENTIFICATION AND LOCATION

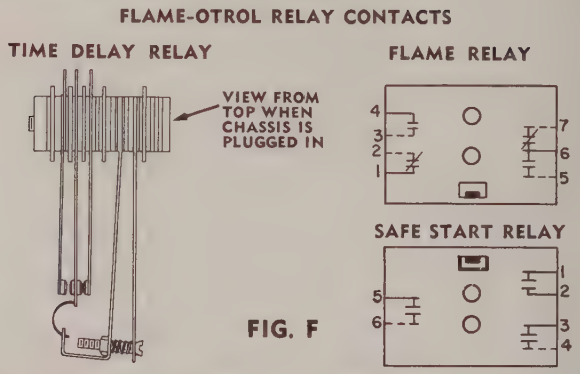


FIG. F

Figure (F) is a pictorial view of all three relays in the 1570. The numbers marked on the left and right hand sides of the flame, and safe-start relays are the leaf numbers from the frame. The Time Delay Relay is shown in the de-energized position. When the relay is powered, it will make contact to the left.

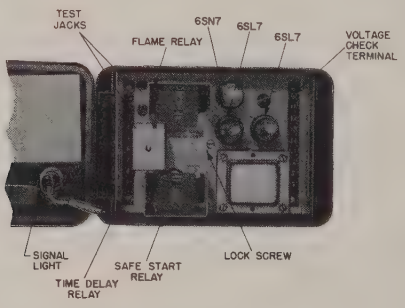


FIG. G

Location of relay assemblies, vacuum tubes and test jacks are shown in Fig. G. Relays are designated as safe-start (SS) relay, time delay (TD) relay, and flame (F) relay. Test jacks are provided on the chassis for the purpose of checking satisfactory pilots and main flames with a D.C. voltmeter. In addition, it is possible to determine if the electronic network is in order. Insulated test probes should be used. Range of meter should be suitable for voltages up to 150 volts D.C.

TESTING PROCEDURE

With fire present and power on the 1570, the flame relay voltage at the test jacks should indicate a reading of 90 to 120 volts D.C. if input voltage is proper and provided Flame Eye has a clear view of the flame.

Voltage at which flame relay pulls in is approximately 65 to 75 volts D.C.

Drop out of flame relay takes place at approximately 30 to 40 volts D.C.

The following items can be determined through a voltage check.

1—Aging of vacuum tubes after a period of 6 to 8 months of operation can be determined through a drop in this reading compared to the reading taken when equipment was initially put into operation, or at the time of installation of a new set of tubes.

2—Instability of the flame, or a poorly adjusted burner which allows too short a flame can be immediately detected by an unstable voltage reading.

3—Increases or decreases of input line voltages result in minor increases or decreases of flame circuit voltages.

If several burners are firing into the same combustion chamber and if each burner is to be monitored individually, care must be taken in applying the Flame Eye to each burner to forestall interference from adjacent burners. The angle of sight for each Flame Eye should only view the particular burner to be monitored. To insure against pick up of flame of adjacent burners, check each burner through the use of the D.C. voltmeter. If the burner being checked has no fire on it and the voltmeter is picking up a reading of more than 6, the Flame Eye is not sighted correctly and is seeing the adjacent burner. Steps should be taken to change the location of the Flame Eye sight port or cut down the size of the port, thereby blocking the view of the adjacent burner fire.

MINIMUM PILOT TEST

Turn "OFF" power to control. Close manual shut off valve, or disconnect main fuel valve in main fuel line. Turn "ON" power to control and light off pilot as described in Sequence of Operation (Page 10). Reduce size of pilot flame until flame relay drops out. (If D.C. Voltmeter is used approximately 30 to 40 volts reading.)

Relight and increase size of pilot flame until flame relay just pulls in (approximately 65 to 75 volts). Turn off power if wiring to main fuel valve has been disconnected. (If shutoff valve had been used to keep main fuel line closed, previous step is unnecessary and may be omitted.) Reopen shutoff valve and light main burner.

Main Flame should light reliably from this size pilot flame. If it does not, the sighting of the Flame Eye scanner must be rearranged so that the reduced pilot light will reliably light the main burner. This means it will require a larger size pilot flame with the Flame Eye sighting further out from the pilot burner at the end of the longer flame. Minimum Pilot Test should be repeated after resighting Flame Eye until reliable lightoff of main burner is accomplished. If possible, increase size of pilot flame for extra safety margin for main burner lightoff.

MAIN FLAME FAILURE TEST

After achieving a normal start-up of a burner with an interrupted pilot, shut off the main fuel. The main fuel valve will de-energize in 2 to 4 seconds after flame goes out and flame relay de-energizes.

After achieving a normal start-up of burner with an intermittent pilot, and only one Flame Eye scanner is being used to supervise both pilot and main flame, you must turn off pilot flame before making main flame failure test, then shut off the main fuel. The main fuel valve will de-energize in 2 to 4 seconds after flame goes out and flame relay de-energizes.

TEST FOR BLINDING OF FLAME EYE SCANNER

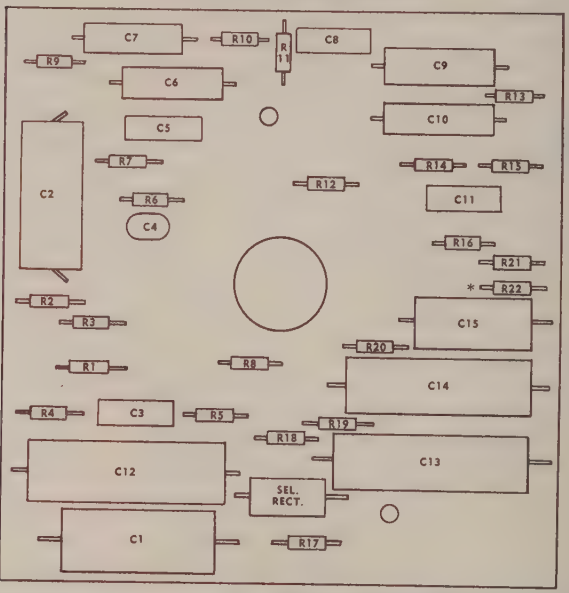
Allow the burner to fire at a high rate until any refractory in the chamber has reached its maximum temperature. At this point check reading at Test Jacks with D.C. Voltmeter to see if voltage is fairly steady and at least approximately 80 volts. If meter needle has occasional dips to approximately 70 volts or less, it may be caused by hot refractory background. Arrange to have someone hold in the flame relay while the Flame Eye Scanner is removed and an observation is made through the sighting tube to determine whether background is the cause. (There is also a possibility that the amount of flame being viewed at the end of the sighting tube is reduced giving a corresponding reduction in signal.) If either of the previously mentioned conditions are occurring, resighting of Flame Eye to cooler or lower temperature background, or maintaining flame over full area of sighting tube opening is necessary. This will eliminate nuisance shutdowns caused by these conditions during sustained periods of operation at high firing rates.

TEST FOR AIR OR STEAM MODULATION OF REFRACTORY SIGNAL

After making the previous test and determining that Flame Eye will not be blinded even though there may be bright refractory background, another test should be made. When refractory has reached maximum operating temperature, shut off main fuel supply. If Main Fuel Valve does not de-energize in 2 to 4 seconds after fuel has been shut off, there is possibly some modulation of the light from the background occurring. This could be caused by Blower Air currents in the case of Gas Fuel, or by atomizing steam in the case of Heavy Oil. To eliminate this condition requires the installation of an orifice in the sighting tube sized to hold the relay only when flame is present and not when air or steam only is entering the viewing area and modulating the signal from bright refractory.

WHEELCO "IR" INFRA-RED LEAD SULPHIDE SYSTEM
MODEL 1570 FLAME-OTROL PRINTED CIRCUIT BOARD

LAYOUT OF COMPONENTS



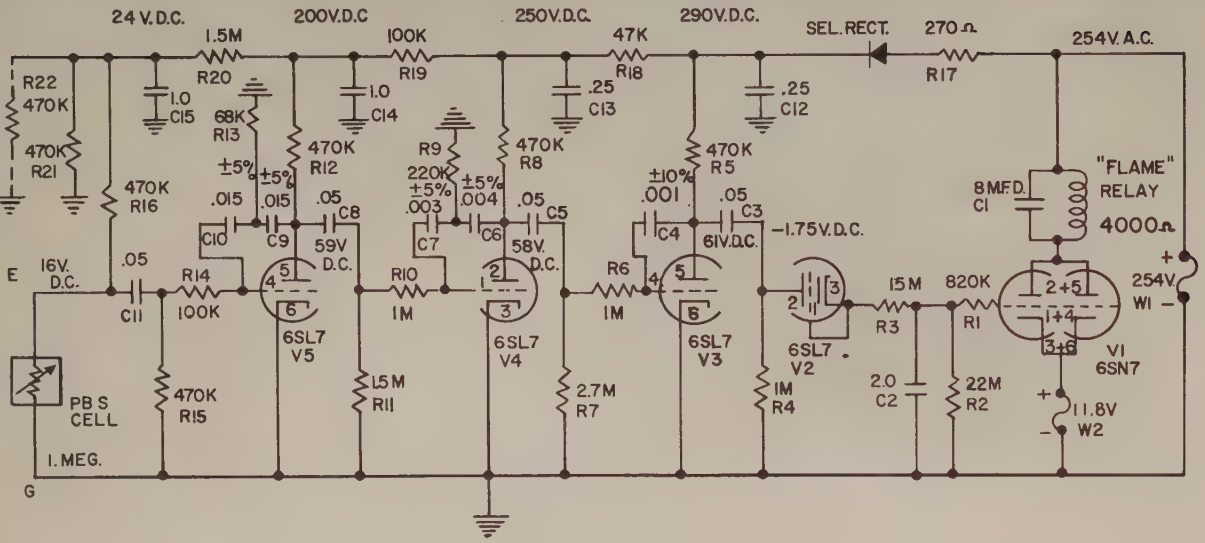
* R22 MAY BE CLIPPED WHERE INCREASED SENSITIVITY IS REQUIRED

ORDERING NO.	DESCRIPTION
	CONDENSERS
39-045-2	Condenser .25 MFD 400 V.D.C. C12, 13
39-071	Condenser .003 MFD 400 V.D.C. C7
39-072	Condenser .004 MFD 400 V.D.C. C6
39-077	Condenser 2 MFD 200 V.D.C. C2
39-083	Condenser .015 MFD 400 V.D.C. C9, 10
39-098	Condenser 1.0 MFD 200 V.D.C. C15
39-099	Condenser 1.0 MFD 400 V.D.C. C14
39-101-1	Condenser .05 MFD 400 V.D.C. C3, 5, 8, 11
39-102-1	Condenser .001 MFD 500 V.D.C. C4
CYZR-327-1	Condenser 8 MFD 250 V.D.C. C1
37-016	Selenium Rectifier

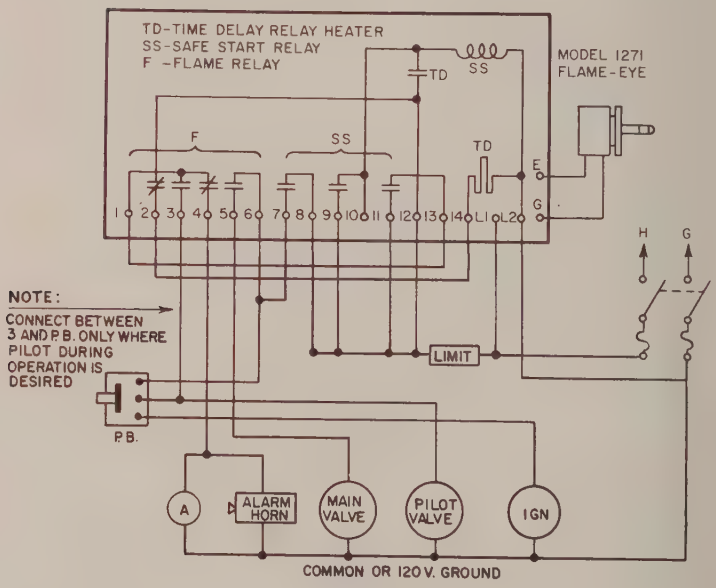
ORDERING NO.	DESCRIPTION
	RESISTORS
40-019-1	Resistor 100K ½W ±10% R14, 19
40-021	Resistor 1.5M ½W ±10% R3, 11, 20
40-039	Resistor 22M ½W ±10% R2
40-090-1	Resistor 820K ½W ±5% R1
40-023-3	Resistor 47K 1W ±10% R18
40-077	Resistor 270 ohm ½W ±10% R17
40-109-1	Resistor 220K ½W ±5% R9
40-110	Resistor 68K ½W ±5% R13
40-111	Resistor 470K ½W ±5% R5, 8, 12, 15, 16, 21, 22
CYZR-170-17	Resistor 2.7M ½W ±10% R7
CYZR-170-41	Resistor 1M ½W ±10% R4, 6, 10

BARBER-COLMAN "IR" INFRA-RED LEAD SULPHIDE SYSTEM 1500 SERIES FLAME-OTROL DETECTOR CIRCUIT INTERNAL WIRING DIAGRAM

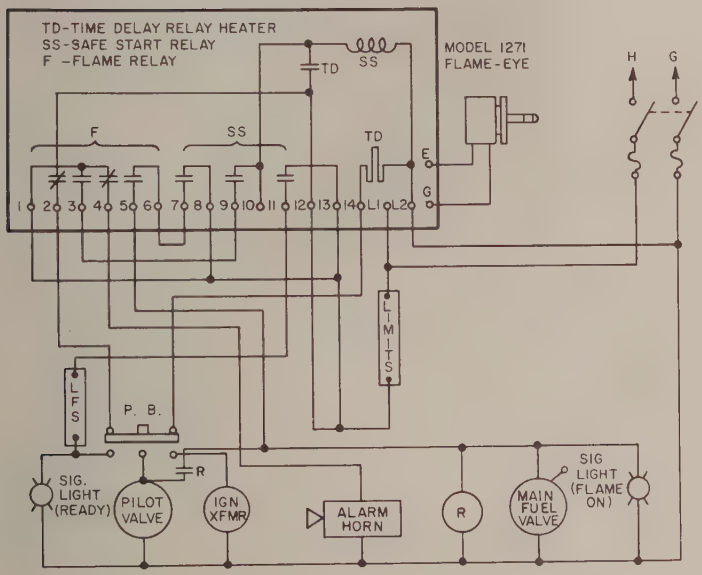
This circuit applies to Flame-otrol Model 1570 using a printed circuit board.
All resistors, capacitors and selenium rectifier mounted on board.



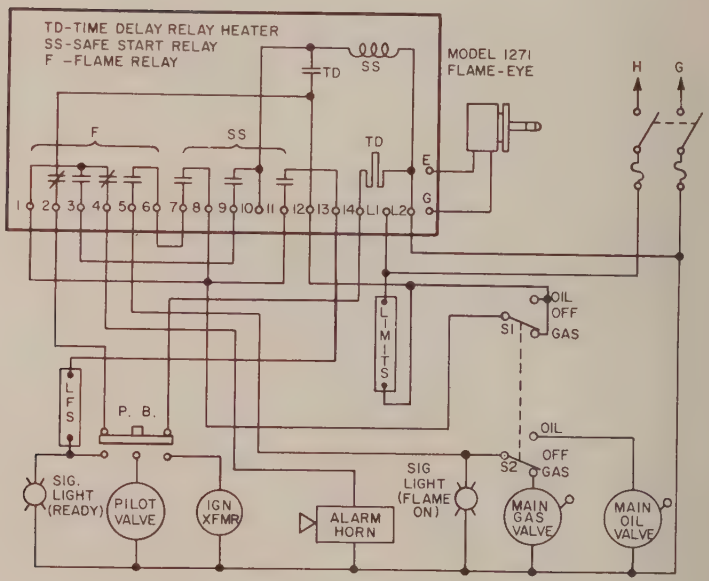
Recommended Practice for Complete Flame Failure Protection of a Gas or Oil Fuel Burner with Proven Pilot. (Continuous or Interrupted Pilot — See Note).



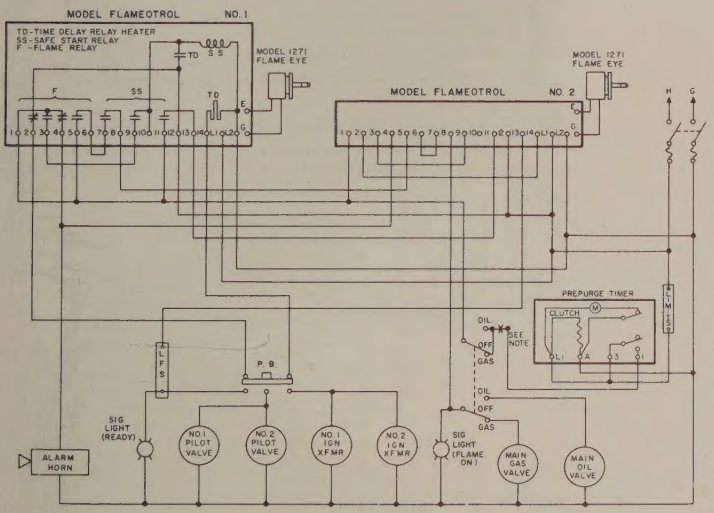
Recommended Practice for Complete Flame Failure Protection on an On-Off or Hi-Low-Off Fired Single Fuel (Gas or Oil) Burner with Limited Push Button Ignition of a Continuous Pilot.



Recommended Practice for Complete Flame Failure Protection on One Continuously Fired Dual-Fuel (Gas-Oil) Burner with Limited Push Button Ignition and Interrupted Pilot.



Recommended Practice for Complete Flame Failure Protection on Two Continuously Fired Dual-Fuel (Gas-Oil) Burners with Limited Push Button Ignition and Interrupted Pilot with Timed Prepurge.



Note on installation using exhaust or recirculating fans or induced draft fans, combustion air blower or forced draft fan motor starter coil should be energized from Terminal 1 of Prepurge timer. Air flow switch should be connected in series between Terminal 1 and oil and gas selector switches at X.

Recommended Practice for Complete Flame Failure Protection on a Single Burner, Duel Fuel, Limited Push Button Ignition of Pilot, and Timed Trial for Ignition of Main Fuel.

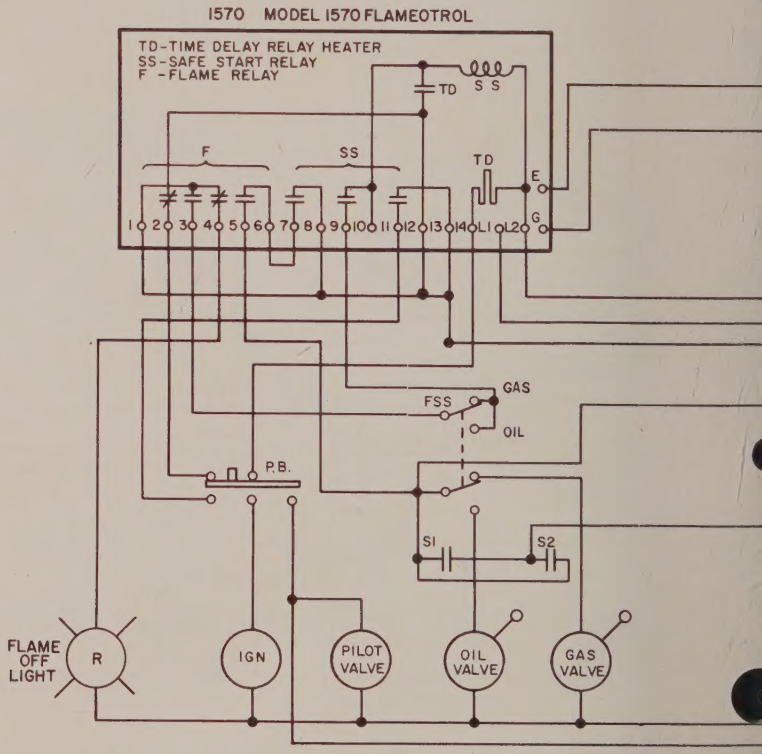
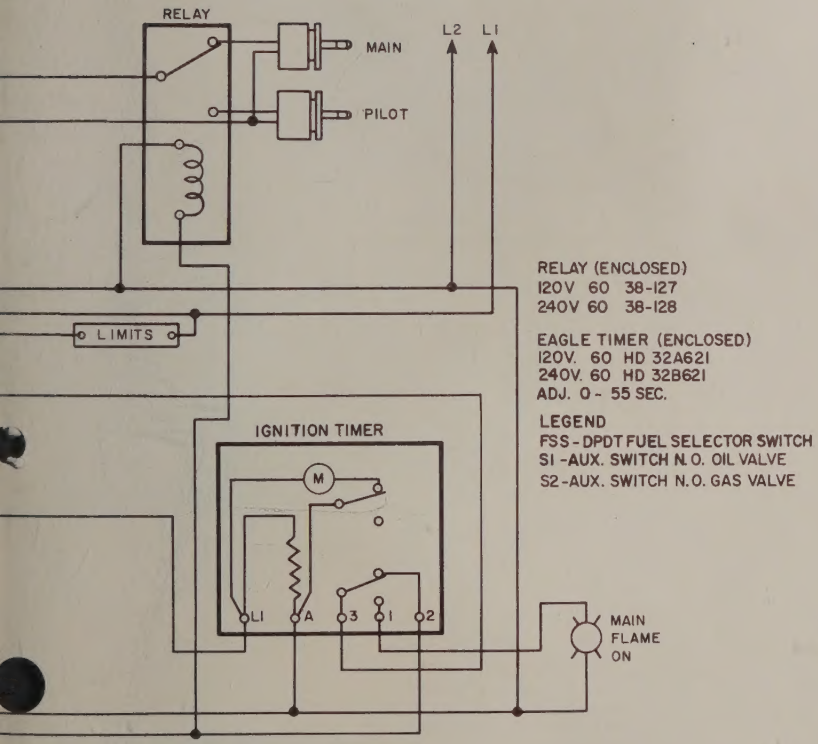


FIG. H

Depressing push button uses cool down time of Time Delay Relay as timing limit for establishing pilot flame. Auxiliary relay is energized when push button is depressed and completes pilot scanner circuit. As soon as pilot flame is established and detected by pilot scanner, Terminal 5 will be powered. Push button can now be released and ignition transformer will be de-energized. Pilot valve and auxiliary relay will remain energized through timer contact 3-2 from Terminal 5. Main fuel valve will be energized through fuel selector switch



from 5. Manual opening of main fuel valve will close auxiliary switch at fuel valve and power timer at L1. Timer will complete timing cycle, contact 3-2 will open de-energizing pilot valve and auxiliary relay completing main flame scanner circuit, and contact 2-1 will close energizing "Main Flame-on" light. Main flame must be established and detected by main flame scanner or flame relay will be de-energized and safe-start relay holding circuit will be opened shutting off fuel valves.

MP MASTER
MA32083

Warranty and Inspection Card — PLEASE FILL OUT AND RETURN

This equipment is guaranteed in accordance with the statement of warranty appearing on our quotation and acknowledgement forms. Upon receipt of this card properly filled out Warranty becomes effective. All Barber-Colman instruments are manufactured to the highest standards of quality and are carefully inspected before packing. Instruments which have been damaged or fail to operate upon installation, should be reported to the Factory at once.

Barber-Colman Company
Industrial Instruments Division

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FINAL INSPECTION

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